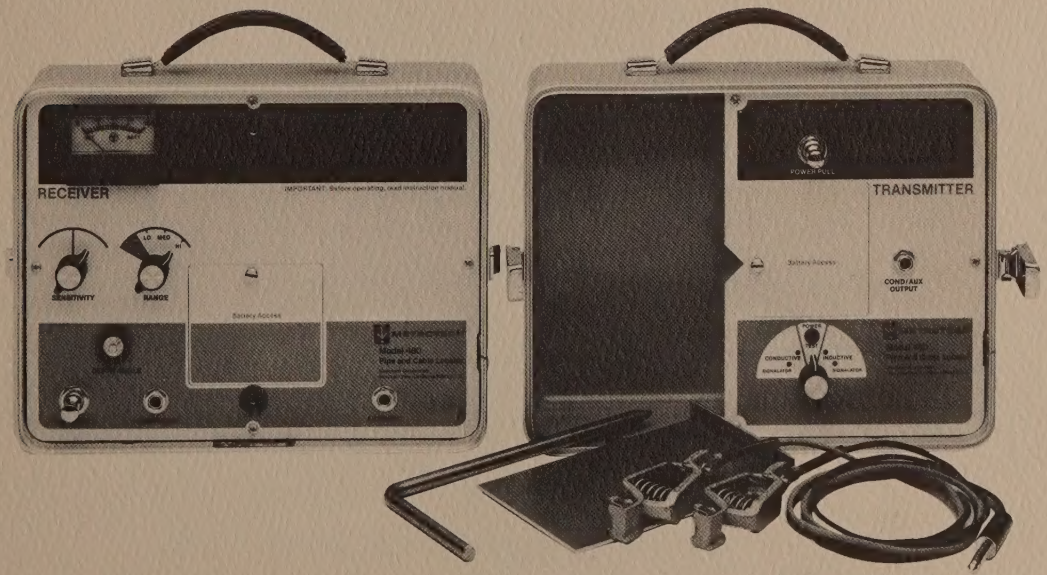
METROTECH

670 National Avenue
Mountain View, CA 94043



PIPE & CABLE LOCATOR
MODEL 480

Part No. 600A002

Operation Manual

NOTICE

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RECEIVER CONTROLS	FUNCTION
1. Visual Indicator; Battery Test Meter	Gives a visual indication of the strength of signal being received, on a scale from 0 to 100. Also used for reading the condition of the receiver battery.
2. SENSITIVITY Control	Controls the sensitivity (gain) of the receiver.
3. DEPTH ANGLE Indicator	Provides a quick and accurate method of measuring a 45 degree tilt of the receiver for triangulation in determining the depth of a conductor.
4. POWER Pull	Pull to apply power to the receiver. This switch should be turned off to prolong battery life when not in use.
5. HEADPHONE Jack	Transfers all audible signals from the speaker to the headphones.
6. Built-in Speaker	Provides an audible signal corresponding to visual indicator readings.
7. RANGE Switch	Provides LO, MED, or HI receiver levels. "BATT" position tests receiver battery when POWER Pull switch is on.
8. AUX INPUT Jack	Provides a receptacle for optional accessories, and disables receiver loop operation.
9. BATTERY ACCESS Door	To change the batteries, undo the retaining screws.

Table 1-1 Summary of Transmitter and Receiver Controls

TRANSMITTER CONTROLS	FUNCTION
10. MODE Switch (5 positions)	CONDUCTIVE position is used when the transmitter is connected directly to the conductor being traced. INDUCTIVE position is used for in-handle operation and induced (air) coupling to a conductor. POWER TEST activates indicator when power is on. SIGNALATOR positions provide interrupted signal or tone for tracing operation in conductive and inductive modes. Not used for handle operation. Consistent use of signalator while tracing extends battery life.
11. POWER TEST Indicator	Flashing light shows adequate battery condition and transmitter power output.
12. COND/AUX OUTPUT Jack	Provides receptacle for conductive ground cable assembly and accessories during contact tracing operations.
13. POWER Pull	Pull to apply power to the transmitter. This switch should be turned off to prolong battery life when not in use.
14. BATTERY ACCESS Door	To change the batteries, undo the retaining screws.

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The Operation Manual

1.01 This manual tells you how to operate and maintain the Model 480 Pipe and Cable Locator. This equipment is simple to operate, and maintenance is limited to replacing the batteries.

1.02 The 480 Locator shows the presence of an underground pipe or cable as a meter indication and as an audible tone. These indications will vary during use due to the size and depth of the pipe or cable, and whether it is wrapped, coated or bare. Receiver indications will also be affected by the conductivity of the surrounding soil, the length of time it has been buried, and the location of other buried pipes and cables.

1.03 This manual will give you the basics of cable and pipe locating. If you have difficulty with a particular situation, METROTECH can help you. You can call the Customer Service department on 1-800-METRO TC (Overseas and inside California call (415) 965-9208). METROTECH can also supply training material, application and technical notes.

NOTE

The word "conductor" is used in this manual to describe a continuous metallic pipe, cable, or conduit.

Description of the Equipment

1.04 The equipment consists of the standard equipment listed below, and several optional accessories:

Standard Equipment:

1. Transmitter (202170);
2. Receiver (202162);
3. Direct connect Cable, Ground Spike and Ground Plate (800B004).

Optional Accessories:

1. Carrying handle (200766);
2. Carrying Case (200780);
3. Model 4820 Metroclamp with Accessory Cable;
4. Model 4810 Inductive Probe.

1.05 This equipment is illustrated in Figure 1-1. The transmitter generates a signal which is put onto a pipe or cable. This signal is detected by the receiver when the receiver is positioned over the buried pipe or cable. There are two methods of putting the signal onto the pipe or cable: direct connection or induction.

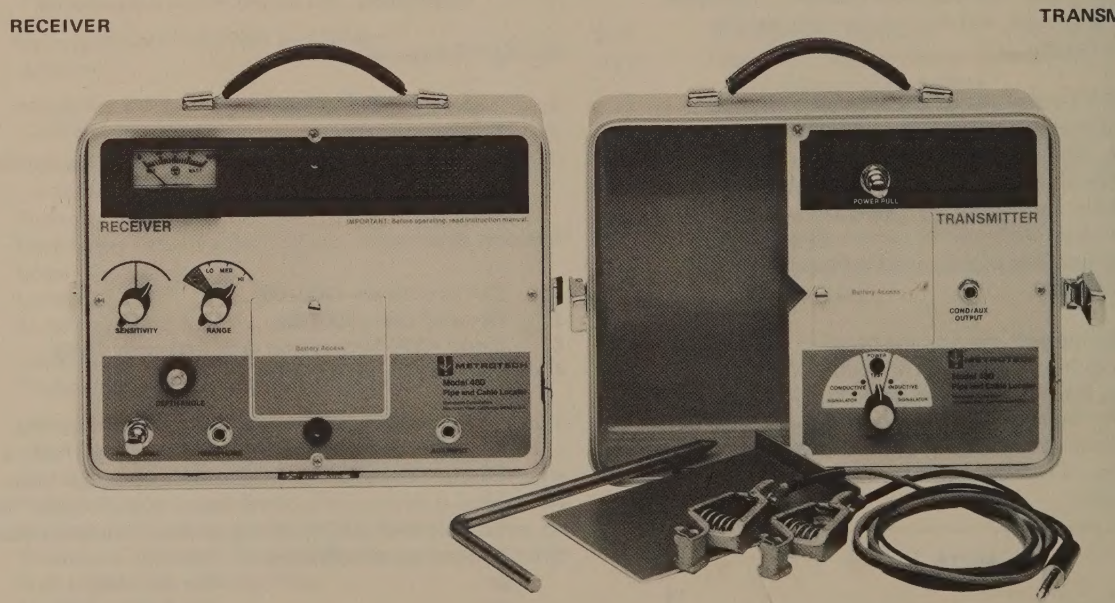


Figure 1-1 Metrotech Model 480 Pipe and Cable Locator

Direct Connection

1.06 The direct connect method is always the preferred method, and should be used whenever possible. This method uses the direct connect cable to connect the transmitter COND/AUX OUTPUT to the conductor. This gives a strong signal to detect, you can use the receiver closer to the transmitter, and other buried pipes or cable are not as likely to interfere with the signal. Also you can connect to a single conductor of a cable, and trace its path even if the conductors in the cable divide.

Induction

1.07 If you cannot connect the transmitter signal directly to the conductor, the transmitter signal can be induced into the conductor by electromagnetic induction. The transmitter generates a magnetic field which couples with the conductor, and a signal is induced into the conductor. It is important to remember that the transmitter field is strong in one direction, and the transmitter must be positioned in relation to the direction of the path of the conductor. There is also the possibility of air coupling between the transmitter and receiver if they are too close.

1.08 An inductive clamp, the Model 4820 Metroclamp, is also available as an option which puts a strong signal onto a conductor.

Measuring the Depth of a Conductor

1.09 The Model 480 can also be used to estimate the depth to which a pipe or cable is buried. This is done by first locating a point directly over the conductor, then moving to one side and detecting its position at a 45 degree angle. The depth of the conductor is equal to the distance between the point over the conductor and the point of the 45 degree measurement. An optional depth probe accessory, Model 4810, is available which will measure the depth of a conductor more easily.

Using the Accessories

1.10 There are two methods of inductive operation, which we call locating or tracing. To locate the position of a buried cable or pipe, connect the transmitter and receiver together with the handle. The equipment will work like a metal detector, and help you find any buried pipe, cable or buried metal object. This method may also be used to follow long sections of pipe or cable, and saves the trouble of moving the transmitter separately from the receiver.

1.11 When the location and direction of the conductor has been found, the transmitter can be taken off the handle and placed over the conductor. The receiver is also removed from the handle and is used to trace the path of the conductor.

1.12 The Metroclamp is available, which is placed around the conductor to be traced. This is the second preferred method of putting a signal onto a pipe or conductor if a direct connection cannot be made. This method also allows you to put a signal on one conductor in a telephone cable, and trace it amongst all of the other conductors.

The APWA Uniform Color Code

1.13 A standard color marking arrangement is used to distinguish between different types of buried pipe or cable. Always use the color which indicates clearly the type of conductor you are marking. These colors are as follows:

Electric Power Lines or Conduits	Safety Red
Communication Lines or Cables	Safety Alert Orange
Gas, Oil, Petroleum or other Hazardous Gases	High Visibility Safety Yellow
Storm and Sanitary Sewers	Safety Green
Water	Safety Precaution Blue

General

2.01 The radio signal from the transmitter is connected directly to the conductor. This may be a hydrant, a conductor in a cable, or any place where a metal to metal connection can be made. The transmitter must be grounded to complete the circuit. Locate the ground point as far as possible from the transmitter and conductor as shown in Figure 2-1. Avoid getting close to or across any adjacent buried conductors.

2.02 To trace non-metalic pipe such as sewer line or a duct, insert a snake or fishtape into the pipe, then connect the transmitter to the inserted conductor. Follow the same instructions. It is recommended that the snake or fishtape be grounded on both ends if possible.

Tracing a Buried Conductor

1. Connect the Direct Connect cable RED lead to the conductor, and plug the other end into the COND/ AUX OUTPUT of the transmitter.

2. Place the transmitter as far as possible from the conductor to be traced, and turn it perpendicular to the conductor.

3. Extend the BLACK (ground) lead as far as possible from the transmitter in a direction away from the conductor to be traced. Insert the ground spike into the ground and connect the ground lead to it. If it is not possible to insert the spike, use the ground plate.

4. Pull the transmitter POWER switch ON.

5. Set the transmitter MODE switch to CONDUCTIVE (or CONDUCTIVE SIGNALATOR if a pulsed signal can be used).

6. Pull the receiver POWER switch ON.

7. Set the receiver SENSITIVITY control to LO.

8. Set the RANGE switch to LO.

9. Trace the conductor, getting the highest reading on the meter and the loudest tone on the speaker. As you get farther from the transmitter, turn the SENSITIVITY to MEDium or HIgh to increase the range of the receiver.

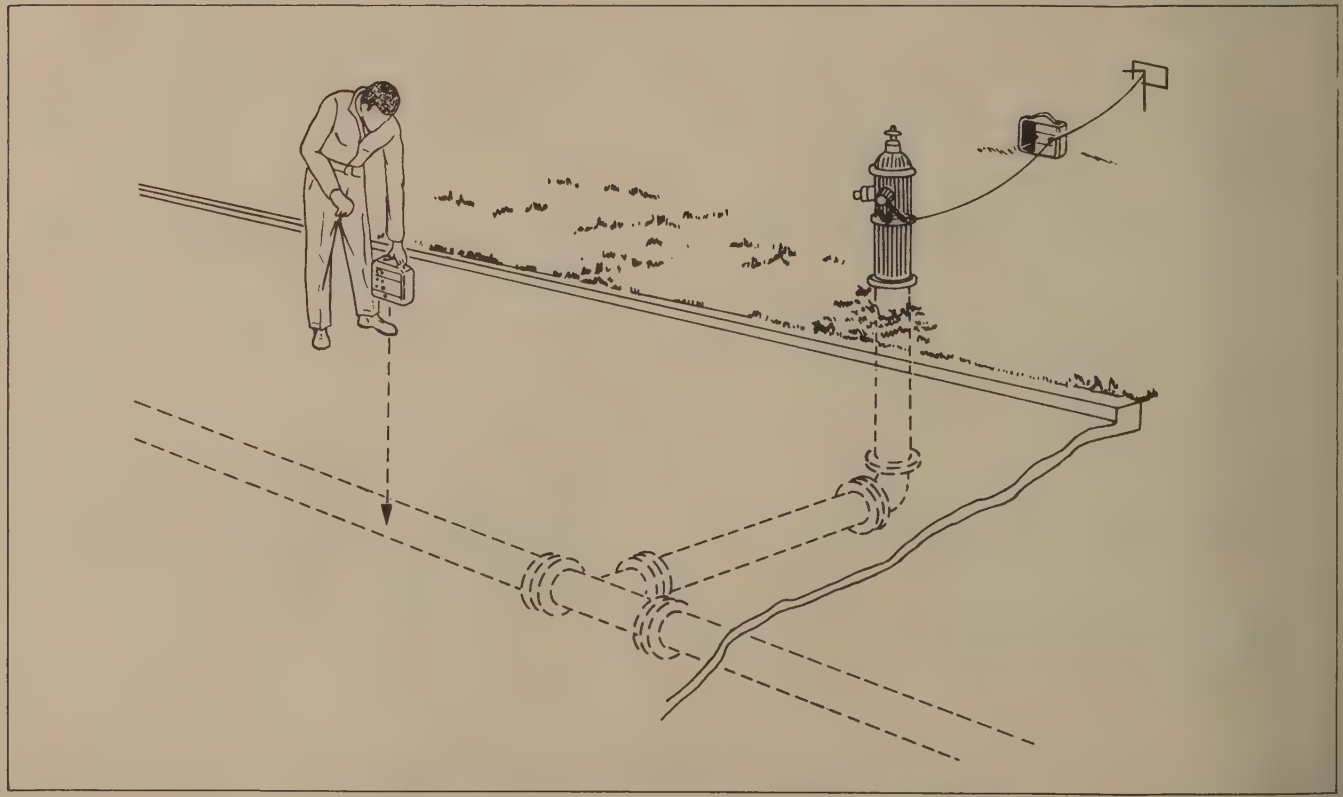


Figure 2-1 Locating Buried Pipe Using the Direct Connection Method

General

3.01 In these procedures, the transmitter and receiver are used independently. Place the transmitter over the conductor to induce a signal along its length.

3.02 The transmitter induces the signal in one direction only. Position the transmitter relative to the buried conductor as shown in the illustrations.

3.03 Use the receiver LO RANGE when working close to the transmitter. Set to MED or HI when moving away from the transmitter where more signal distance is required.

3.04 When using the receiver, hold it as shown in Figure 3-1. Note that there are two ways to hold the receiver; vertically will give a greater or PEAK signal over the conductor, and horizontally will give a NULL over the conductor. The receiver must be either horizontal or vertical, not sloping. Where possible use the PEAK (vertical) position.

3.05 Operation of the SENSITIVITY control on the receiver is very important. Pass the receiver back and forth over the conductor position. Decrease the SENSITIVITY to sharpen the response of the receiver indications, and get a more accurate conductor position.

3.06 Use the SIGNALATOR signal where possible to prolong the transmitter battery life. Use the PEAK mode with the Signalator signal.

3.07 To prevent direct coupling between the transmitter and receiver, make sure that the receiver is farther away than these distances:

RECEIVER RANGE SETTING	MINIMUM DISTANCE FEET
LO	35
MED	95
HI	150

It is possible to shorten these distances by reducing the SENSITIVITY control of the receiver.

Tracing a Buried Pipe or Cable

1. Pull the transmitter POWER switch ON.
2. Set the transmitter MODE switch to INDUCTIVE (or SIGNALATOR and use PEAK mode).
3. Position the transmitter over the buried conductor as shown in Figures 3-1, 3-2, and 3-3.
4. Pull the receiver POWER switch ON.
5. Set the SENSITIVITY HI (fully clockwise) and the RANGE switch LO.

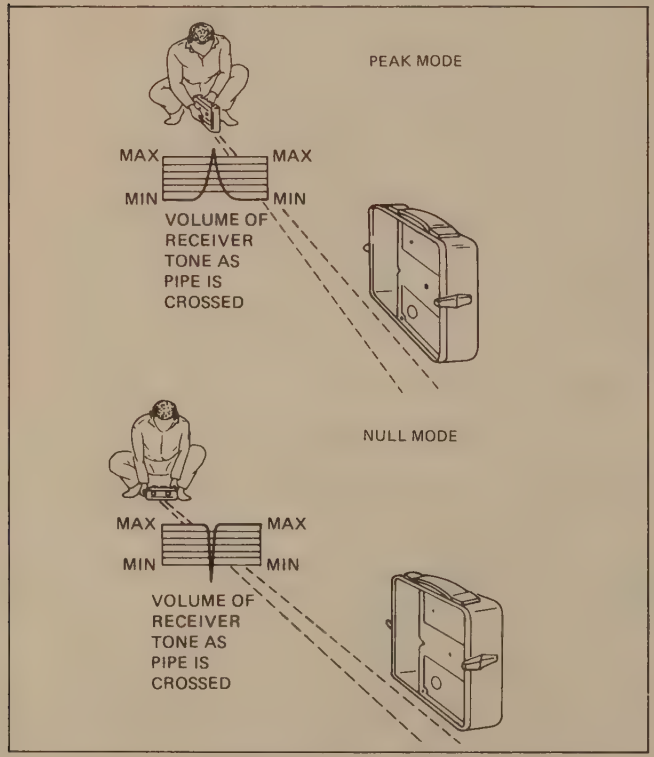


Figure 3-1 Positioning the Transmitter and Receiver for an Induced Signal

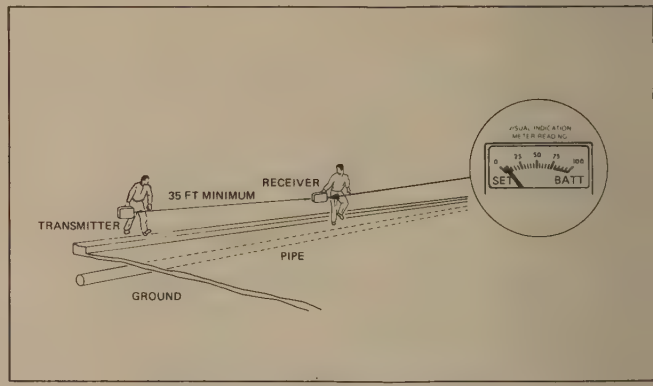


Figure 3-2 Preparing to Trace a Pipe

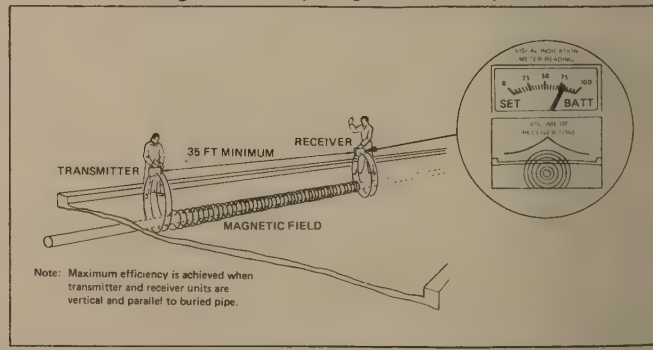


Figure 3-3 Finding the Path of a Buried Pipe

6. Go along the assumed path of the conductor, at least 35 feet away from the transmitter.

7. Position the receiver over the area where the conductor should be, and listen for the audio tone.

8. Position the receiver over the area where the tone appears strongest. Confirm the location of the conductor by obtaining the highest reading on the meter. Mark the spot.

Locating a Service

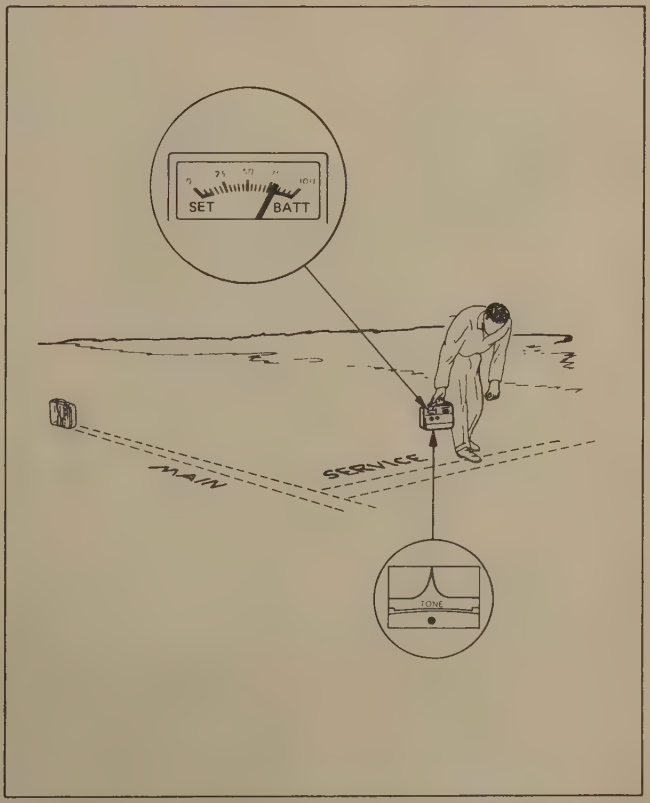
3.08 Figure 3-4 shows how to locate a service from a main pipe.

Locating a Bend

3.09 Figure 3-5 shows how to trace a pipe or cable around a bend.

Locating a Dead End

3.10 The receiver will detect the exact location of the end of a pipe. See Figure 3-6.



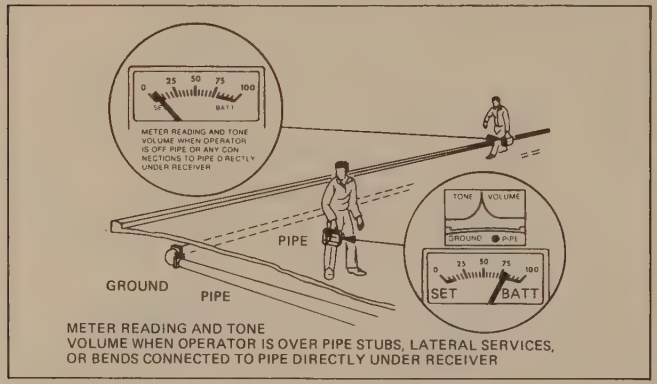


Figure 3-5 Locating a Bend

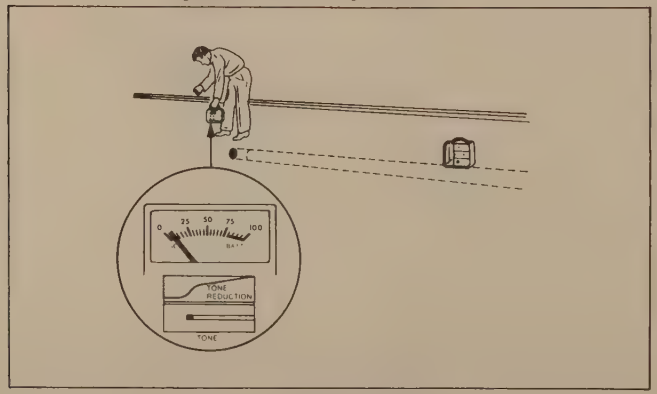


Figure 3-6 Locating a Dead End

General

4.01 This procedure allows you to estimate the depth of a buried conductor. First find the location of the conductor, then tilt the receiver to a 45 degree angle and locate the conductor again. The angle of 45 degrees has been chosen because the depth of the conductor is equal to the distance to the side (on the ground) of the second measurement.

Estimating the Depth of a Buried Conductor

1. Pull the transmitter POWER switch ON.

2. Set the transmitter SENSITIVITY to LO (fully counterclockwise) and the RANGE switch to LO.

3. Place the transmitter over the conductor.

4. Go at least 75 feet from the transmitter and, with the receiver, find and mark the location of the buried conductor. See Figure 4-1.

5. Tilt the receiver to 45 degrees using the bubble on the DEPTH ANGLE indicator on the receiver, and move to the side away from the path of the conductor.

6. Mark the position on the ground. The distance between the two marks is equal to the depth of the cable. See Figure 4-2.

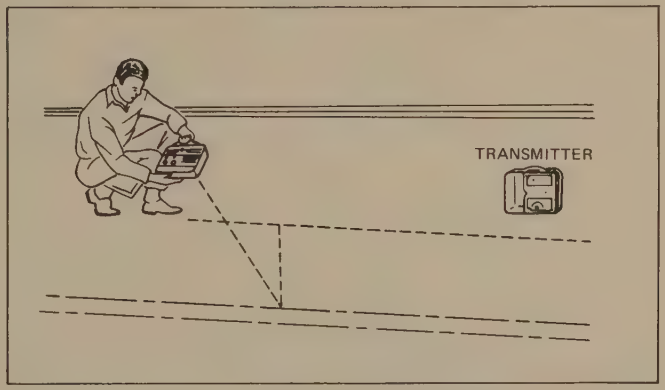


Figure 4-1 Locating a Buried Conductor

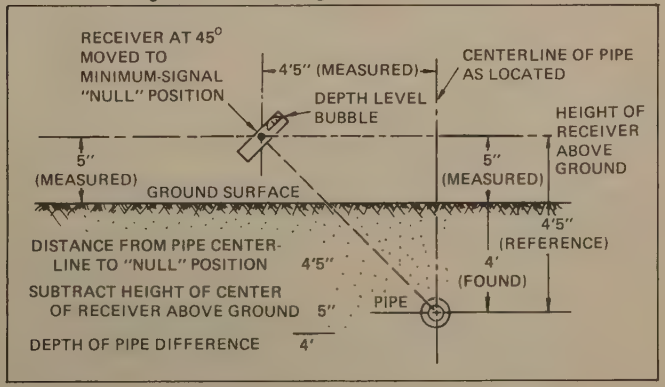


Figure 4-2 Finding the Depth of a Buried Conductor

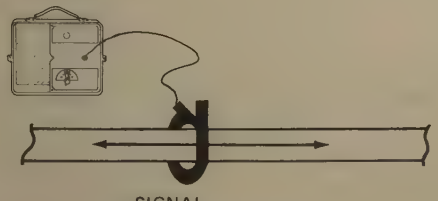
General

5.01 This section tells you how to use the optional accessories listed in Chapter 1.

Using the Model 4820 Metroclamp with the Transmitter

5.02 The Metroclamp is placed around a pipe, cable or a single conductor. When plugged into the COND/AUX OUTPUT of the transmitter, it induces the transmitted radio signal into the conductor without metallic contact.

5.03 If the pipe or cable is continuous in both directions, no grounding is necessary since circuit continuity is provided by the conductor, see Figure 5-1.



Note: Return to ground or ground contact must be provided each side of the clamp.

Figure 5-1 Using the Metroclamp with a Continuous Conductor

5.04 If the circuit path is interrupted by an insulated joint, open end or other break, ground must be provided. Connect the ground jumper to the short part of the conductor, as shown in Figure 5-2.

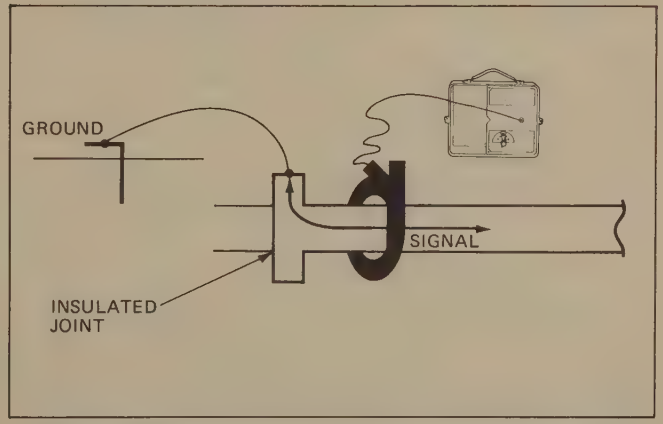


Figure 5-2 Connecting the Metroclamp with a Ground

5.05 A common use for this arrangement is to put a signal onto a single conductor in a cable without damaging the conductor insulation.

5.06 When used with the receiver, it detects the signal placed on the conductor by the transmitter. It is possible to use a Metroclamp at both ends to check a conductor from manhole to manhole, or drop to junction.

5.07 This method of connection allows you to isolate the conductor to be traced without making metallic contact.

1. Plug the Metroclamp connector into the COND/AUX OUTPUT jack.

2. Set the MODE switch to CONDUCTIVE.

3. Pull the POWER switch ON.

4. Place the Metroclamp around the pipe, cable or conductor, making sure that the clamp jaws are closed.

5. Connect ground as shown in Figure 5-2.

6. Trace the conductor with the receiver as described in Chapter 3.

Using the 4820 Metroclamp with the Transmitter and Receiver

5.08 This procedure describes how to trace a conductor using two clamps, one on the Transmitter and one on the Receiver. This is used to trace a single conductor in a cable, or in manhole-to-manhole or drop-to-junction situations.

1. Connect Metroclamp and Transmitter per Steps 1 thru 4 of single operation.

2. Plug the second clamp into the jack marked AUX/INPUT on the Receiver.

3. Turn on POWER switch, put RANGE switch and SENSITIVITY control to required gain position.

4. Now begin the search for the desired conductor, by coupling the Receiver Clamp around each conductor to identify which one is carrying the signal from the Transmitter.

5. The use of two extension poles per 5 of single operation, expands the trace capability to such conditions as manhole-to-manhole conductor tracing without personal entry.

Using the 44 Depth Probe to Measure the Depth of a Conductor

5.09 The Depth Probe gives a more accurate measurement than tilting the receiver by 45°, but you must make a hole about one inch in diameter that is deeper than the level to which the pipe is buried.

1. Locate the pipe and estimate its depth following the procedures given in Chapter 4.

2. Select a location along the pipe that is separated from the transmitter by a distance at least 2 times the suspected depth of the pipe.

3. Make a hole (at least ¾" diameter) within a foot of the edge of the pipe. The hole should extend beyond the pipes estimated depth.

4. Assemble the DEPTH PROBE as illustrated in Figure 5-3.

5. Connect the DEPTH PROBE to the receiver by means of the long coiled cord. The "L" shaped plug connects to the end of the DEPTH PROBE and the straight plug is placed in the AUX INPUT jack on the front panel of the receiver.

6. Turn on the transmitter and place it over the conductor.

7. Locate the pipe with the receiver (see Figure 4-1).

8. With the receiver set on MED POWER, slowly lower the DEPTH PROBE into the hole near the pipe. As a signal indication is observed or heard, reduce POWER and SENSITIVITY until the depth of the pipe is indicated by a maximum signal indication at the lowest POWER and SENSITIVITY control settings. See Figure 5-4.

9. Read the depth of the pipe from the scale on the side of the Model 44 DEPTH PROBE.

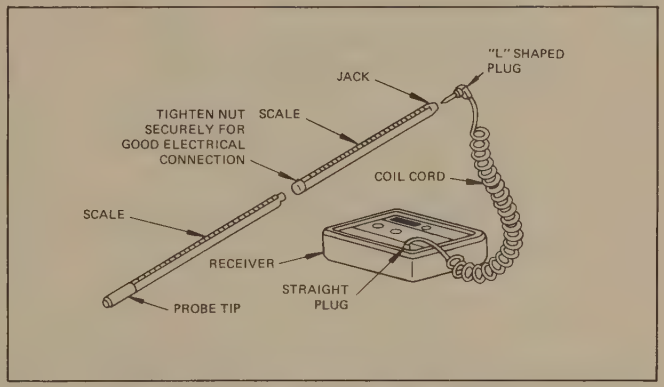


Figure 5-3 Assembling the Depth Probe

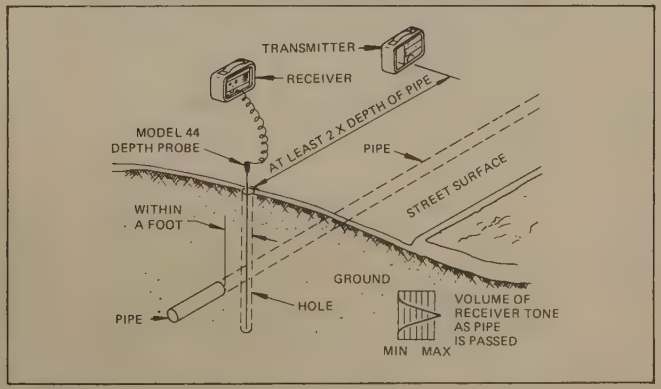


Figure 5-4 Measuring the Depth of a Buried Conductor

Instructions for the Model 4810 Probe

5.10 These instructions describe the use of the 4810 Probe for locating and estimating the depth of a buried conductor.

1. Plug the Inductive Probe into the AUXiliary INPUT on the Receiver.

2. Turn the Receiver SENSITIVITY Control fully ON (clockwise).

3. Turn the Receiver on and follow standard operating instructions.

4. The Inductive Probe works on the null method, shown in Figures 5-5 and 5-6. If you wish to use the maximum method, unplug Inductive Probe and use the built-in receiver case loop antenna.

5. The probe SENSITIVITY Control is located on the probe with the Depth Level, for ease of operation.

6. See Figures 5-7 to 5-9 for triangulation depth determination. First mark the ground surface at actual location of the conductor (Figure 5-7). The Letter "A" (Figure 5-8) is the location of the conductor. Then place the probe at a 45° angle and move it off to one side of the conductor until you reach position "B". The distance between letters "A" and "B" is the depth of the conductor.

7. If the conductor is buried in the shoulder of a hill, make your measurements as shown in Figure 5-9.

   Note: Subtract "C" measurement from the "A" and "B" measurement for the actual depth.

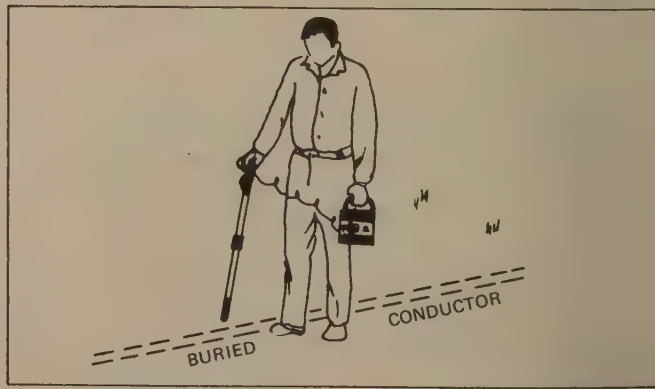


Figure 5-5 Tracing a Conductor Using the Probe

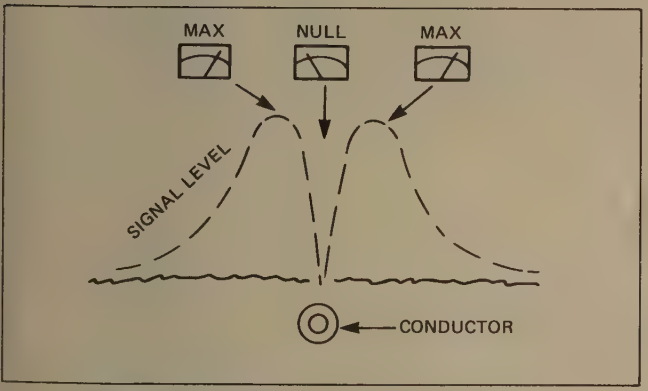


Figure 5-6 Null Indications with the Probe

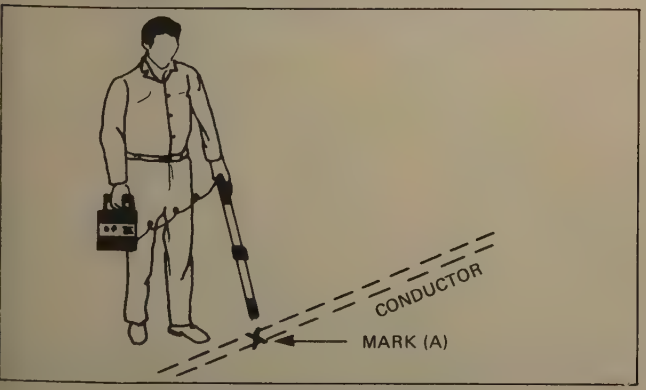


Figure 5-7 Marking a Conductor

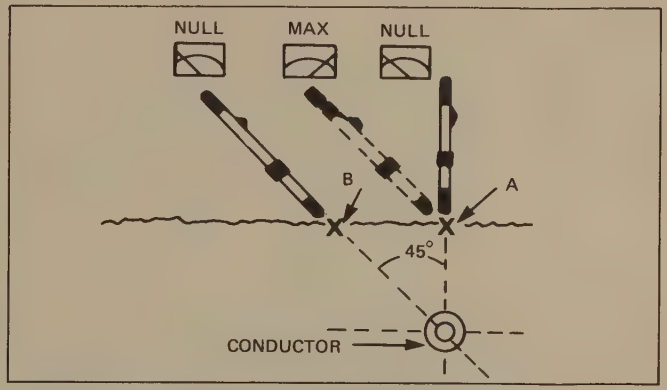


Figure 5-8 Estimating the Depth

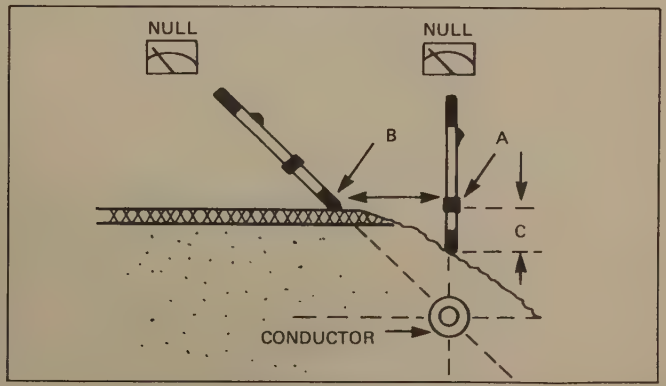


Figure 5-9 Allowing for Uneven Ground

Additional Instructions for Using the 4810 Probe

5.11 Figure 5-10 illustrates how the inductive effect of the cable acts on the probe tip. The lower view shows the difference between the Receiver response and the improved response using the probe.

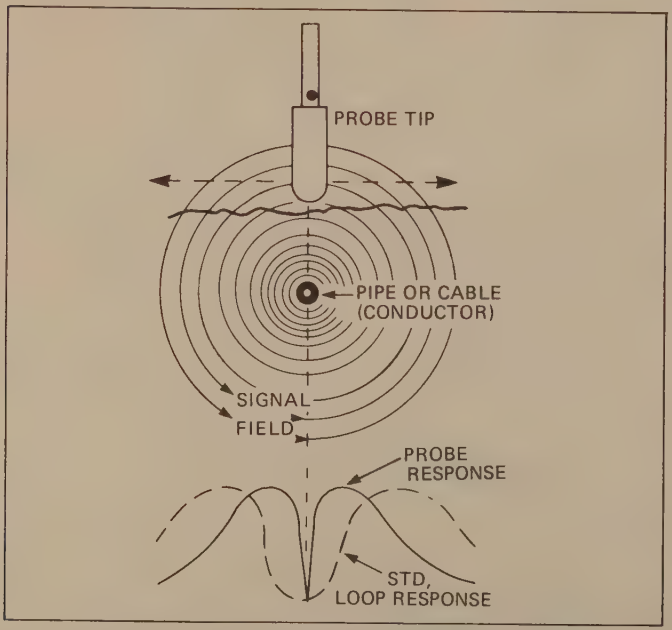


Figure 5-10 Receiver and Probe Responses Compared

5.12 Note the sharp null (minimum) in the signal as the probe points directly to the conductor. By comparison, the much larger dimensions of the standard receiver loop would produce a broader null, as the loop requires more distance to go completely past the target, see Figure 5-11.

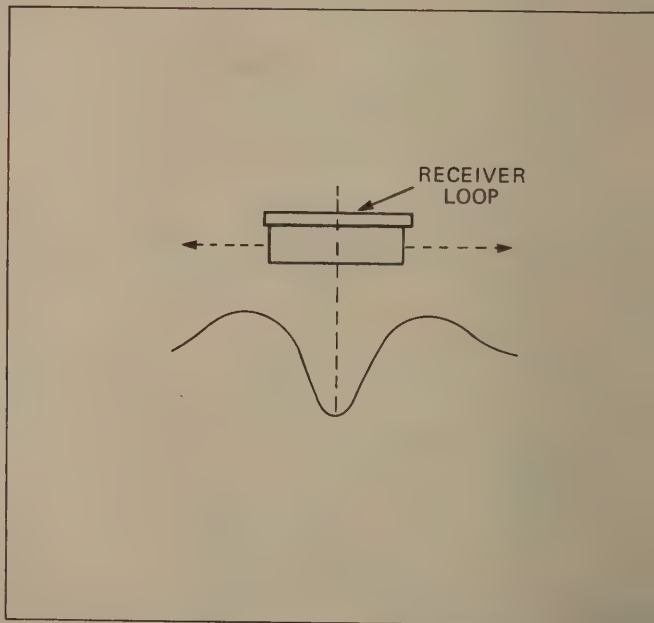


Figure 5-11 The Receiver Response

5.13 The 4810 provides greater accuracy in the presence of adjacent conductors, see Figure 5-12.

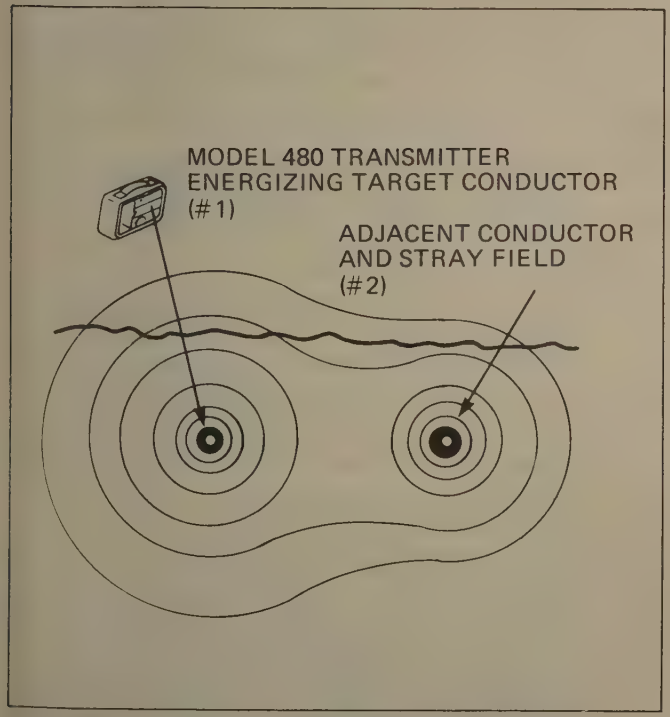


Figure 5-12 Using the Probe to Reduce Interference from Adjacent Conductors

5.14 When the Receiver loop antenna (Metrotech or any other Receiver) is used to pinpoint the conductor's location, the craftsman typically holds the receiver 1 to 3 feet above the ground. This could produce a null displaced 6" or even more toward conductor #2. To minimize this problem, Metrotech has always recommended placement of the receiver as close as possible to the ground when determining conductor location. However, there are numerous and different configurations in which this problem occurs.

5.15 The 4810 Inductive Probe greatly reduces this problem, because its design allows much closer and consistent proximity to the ground and the conductor. While the probe's features are not a cure-all, its use increases the effectiveness of the Model 480 in almost all applications where speed and accuracy are important.

5.16 Improved depth accuracy available with the 4810 Probe using the triangulation method.

5.17 As in depth determination using the standard receiver loop, the distance between A and B equals A to C, the depth to the conductor. But here, the improved performance of the Model 4810 is a result of several of its design features. See Figure 5-13.

1. Full length, adjustable, slender design with antenna in the tip, to assure maximum signal sharpness and intensity in any situation.

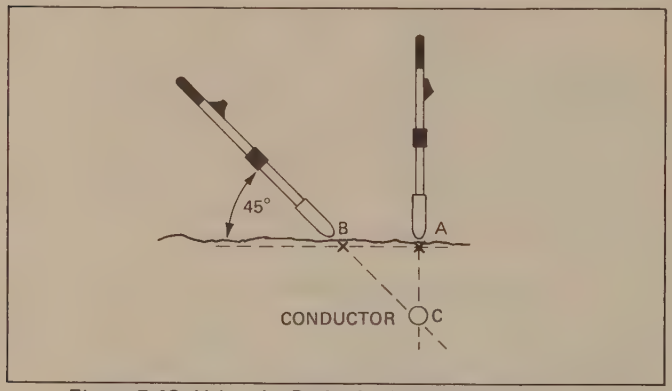


Figure 5-13 Using the Probe for Depth Measurement

2. Ideally positioned bull's-eye level assures maximum accuracy of 45° null location within ½°.

3. Smooth built-in sensitivity control allows convenient adjustment for optimum readings.

Locating Pipe or Buried Cable Using the Carrying Handle

5.18 These instructions describe how to assemble the transmitter and receiver onto the carrying handle, and search for a buried pipe or cable. When assembled, the equipment is used like a metal detector, and will find all buried metal objects within range.

5.19 The strongest signal is obtained when the handle is in line with the target pipe or cable. The signal strength will increase if the volume of metal increases, such as for a valve, tee or stub.

5.20 Use this method to follow long lengths of buried pipe or cable, or to find manhole covers that have been paved over.

5.21 When searching systematically with the 480 on the handle, follow a grid pattern about 4 feet between paths.

Mounting the Model 480 on the Handle

1. Place the handle in the transmitter (see Figure 5-14), and secure it with the screw.

2. Place the transmitter on the ground and mount the receiver as shown in Figure XX, and tighten Screw 'A' about 10 turns to fully compress the spring.

3. Pull the receiver POWER switch ON.

4. Set receiver RANGE switch to LO.

5. Set receiver SENSITIVITY switch to the orange line.

6. Set transmitter MODE switch to INDUCTIVE.

7. Pull transmitter POWER switch ON.

5.22 Because the receiver is operating close to the transmitter, the receiver will detect the transmitter output by air coupling and emit a tone. This problem must be corrected using the following procedure.

Adjusting the Audio Balance of the Model 480

1. Hold the assembled instrument at arms length with the carrying handle parallel to the ground. (Caution: Operator must be at least 15 feet from all possible targets: metal objects, pipes, fences, cars, etc.) See Figure 5-15.

2. To balance the instrument, turn knob "A" counterclockwise until you reach a zero audible and visual signal. Continue to turn through this "no signal" area until a slight signal is heard and the visual indicator reads within the "SET" area.

Locating a Buried Conductor

As you cross conductors at right angles at the point of maximum (or full scale) audio and visual signal, make a mark. Continue to walk in the same direction until "no signal" is registered. At this point, turn around (180°) and walk back over the same path until the maximum signal (or full scale) is registered again. Make a second mark. There are now two marks. The true location of the conductor is midway between the two marks.

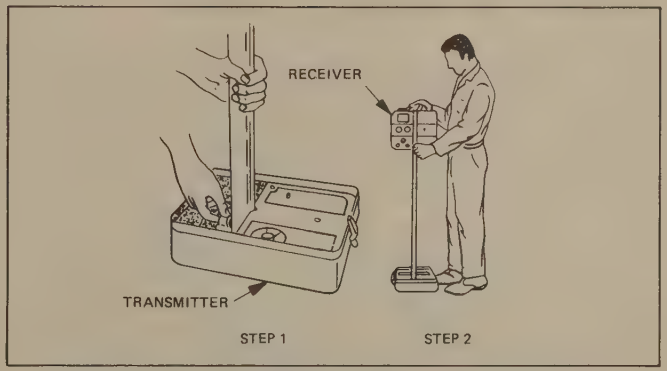


Figure 5-14 Mounting the Transmitter and Receiver on the Carrying Handle

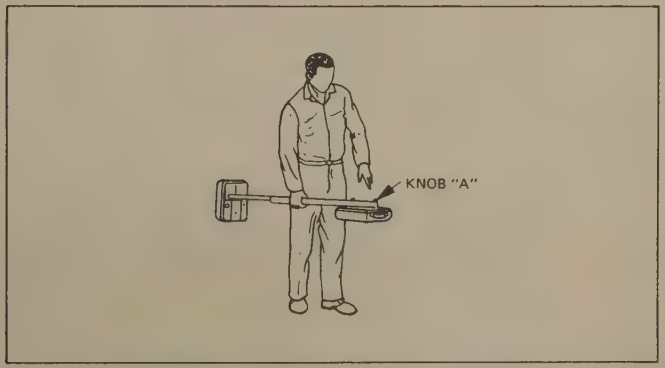


Figure 5-15 Adjusting for Audio Balance

Locating Valves, Manhole Covers, Tees, and Risers

5.23 First locate the conductor by one of the methods previously described. Then proceed along the course (see Figure 5-16). A valve, tee, or stub will be indicated by an increased audio tone and meter reading. The indication is due to the increased metal and surface area of the valve, tee, or stub compared with the metal surface area of the pipe.

5.24 When looking for paved-over manhole covers, the suspected area should be searched systematically in a grid pattern approximately 4 feet apart. A small amount of practice over known manhole covers will enable the operator to pinpoint such items. Tilting the receiver toward the ground is another way to effectively pinpoint and outline such targets.

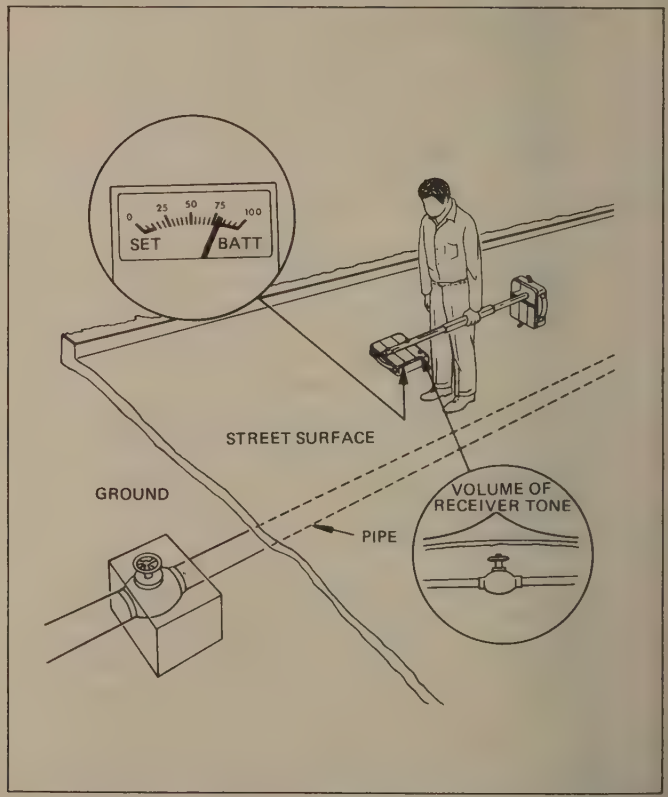


Figure 5-16 Locating Buried Metal or Added Masses of Metal

General

6.01 The only routine maintenance required for the Model 480 equipment and accessories is to replace the batteries. A battery test switch position is provided so that the condition of the batteries can be seen at any time. The indicator light will flash slowly or not at all to locate a low battery condition.

Changing the Batteries

6.02 To change the batteries, remove the screws securing the BATTERY ACCESS panel and remove the panel. Be sure to install the batteries with the positive (+) terminal as shown.

Replacement Batteries

6.03 The Model 480 equipment uses standard alkaline C cells. One set of batteries will give from 250 to 550 hours of service.

Troubleshooting

6.04 All circuits in the Model 480 are mounted on replaceable modules. A service technician can locate a faulty module easily and replace it with a spare. All parts are readily available from the factory.

WARRANTY

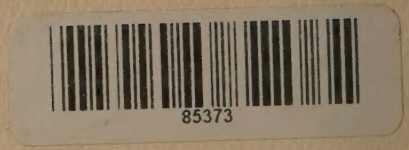
THERE ARE NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY, BEYOND THOSE STATED HEREIN.

Metrotech warrants its equipment to be free from defects in workmanship or material under normal and proper use and service for one year from date of purchase by original user. Metrotech assumes no obligation to repair or replace equipment which has been altered or repaired by other than Metrotech approved procedure; been subject to misuse, misapplication, improper maintenance, negligence or accident; had its serial number or any part thereof altered, defaced or removed; or been used with parts other than those approved by Metrotech. Warranty does not include batteries. Expendable items such as fuses and lamps are excluded.

Any detection product proved defective under this warranty will be repaired or replaced free of charge at the Metrotech Corporation factory or approved Metrotech repair station. The equipment should be returned to our factory by prepaid transportation after requesting and receiving return authorization from our Service Department.

Metrotech's obligations are limited to repair or replacement of broken or defective parts which have not been abused, misused, altered or accidentally damaged, or at the option of Metrotech, to refund of the purchase price. Metrotech assumes no liability for removal or installation costs, consequential damages, or contingent expenses of any other nature.

NOTES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